Synchronization of two pulse-coupled non-identical BZ oscillators with time delay

Anastasia Lavrova & Vladimir Vanag
Immanuel Kant Baltic Federal University, Innovation Park, Center of Nonlinear Chemistry, Kaliningrad, Russia

Recently [1] the system of two identical pulse-coupled chemical oscillators has been investigated experimentally as well as theoretically. This system has been presented by ferroin-catalyzed Belousov–Zhabotinsky (BZ) oscillators with time delay operated in continuously fed stirred tank reactors (CSTRs). To simulate experimental results, the five-variable model of the BZ reaction was constructed [1].
Herein, we study four-variable BZ model, where two non-identical, frequency-different oscillators are considered [2]. Mutual excitatory, mutual inhibitory, and excitatory-inhibitory types of coupling are investigated. The model has allowed us to analyze the effect of frequency difference on the resonant synchronization regimes of two-coupled oscillators and on the switching between these regimes. In particular, in comparing with previous results, we have performed a thorough phase analysis and identified parameters of time delay and coupling strengths that can efficiently induce switches in a system activity. We have shown that abrupt changes between different rhythms can occur depending on the coupling strengths and time delay between two oscillators, and there exist zones, where one of the oscillators is suppressed.

1. V. Horvath, P. Luigi Gentili, V. K. Vanag, and I. R. Epstein, *Angew. Chem. Int. Ed.*, **51**, 6878 (2012)
2. A. I. Lavrova, V. K. Vanag. Two pulse-coupled non-identical (frequency-different) BZ oscillators with time delay (in preparation)